MONTHLY WEATHER REVIEW.

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WAR DEPARTMENT,

OFFICE OF THE CHIEF SIGNAL OFFICER,

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

The meteorological data collected in this office during the month of June and until the 20th of July, 1882, has been carefully examined and a general summary of the several elements for each district in the United States, is presented in this REVIEW.

The temperature during the month of June averaged from 0.1 to 0.2 of a degree above the normal in the districts on the Atlantic coast; it rose slightly in all other districts east of the Rocky mountains, and this increase over the low mean temperature of the previous month, has been favorable to agricultural interests, especially in the eastern and southern sections of the country, where the crops have been greatly improved. The wheat crop has been secured in the southern districts and harvesting was in progress as far north as the fortieth parallel, at the close of the month. Heavy rains in the states north of the Ohio valley and in sections of the northwest, injured the growing corn, and the late spring reduced the acreage of this crop, but the recent warm weather in these sections has greatly improved its condition.

On the Pacific coast, the rainfall has been slightly below the mean for the month, except in southern California, and the wheat crop of Oregon and Washington territory promises to be above the average, while that of California will probably fall slightly below the average.

The cotton region reports have been continued, and for the purposes of comparison, the conditions of rainfall and temperature are given for the months, April, May and June. The warm weather of June in the cotton growing regions has improved the condition of the crop, in the Gulf and south Atlantic states. Reports from the lower Mississippi valley, indicate that a good, but late crop will be produced in the overflowed districts.

The month has been particularly marked by the occurrence of severe local storms and tornadoes, which in many cases, caused great loss of life and property. These destructive storms occurred in almost every section of the country, but were most numerous in the states of the upper Mississippi and lower Missouri valleys. The tornado which occurred in eastern Iowa on the night of the 17th, was the most destructive storm of the month.

Ocean ice continued in the north Atlantic during the month, but it will be seen from the chart that the area within which vessels have reported ice or icebergs, is not so large as in the previous month, although icebergs were observed in longitudes farther to the east, than in either May or April. Several vessels were wrecked in the ice-fields of the north Atlantic during the month, and the chart may be of service in selecting the safe routes for vessels leaving the Atlantic ports. The vessel reports, which give the latitude and longitude in which ice was observed will be found under the heading of OCEAN ICE. Under the same heading is given, an interesting extract of an article written by Mr. E. Douglas Archibald, in which the writer discusses the subject of ocean ice and gives its years of maximum frequency, compared with the years of maximum sun-spots.

That part of the REVIEW referring to International Meteorology, presents the general weather conditions which prevailed over the northern hemisphere during the month of April, 1880, and the tracks of barometric minima for July, 1880, traced from simultaneous observations taken at 7.35 a. m., Washington mean time. The month of April was chiefly remarkable for the high temperatures which prevailed in central Europe, and as an interesting feature of chart v., may be mentioned, the tracing of the first typhoon of July 1880, occurring in the China sea.

In the preparation of this REVIEW the following data have been used, viz.: the regular tri-daily weather charts, containing the data of simultaneous observations taken at one hundred and thirty-six Signal Service stations and fourteen Canadian stations, as telegraphed to this office; one hundred and eighty monthly journals and one hundred and seventy-one monthly means from the former, and fourteen monthly means from the latter; one hundred and eighty monthly registers from voluntary observers; forty-eight monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; Marine Reports through the co-operation of the New York Herald Weather Service; abstracts of Ships' Logs, furnished by the publishers of "The New York Maritime Register"; monthly reports from the local weather services of Kansas, Nebraska, and Missouri, and of the Central Pacific railway company; trustworthy newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The distribution of mean atmospheric pressure for the month of June, 1882, is shown by isobarometric lines, in black, on chart number ii.

The area of lowest mean pressure occupies the region north of New England, extending over the lower Saint Lawrence valley, and the second depression, extends over the Rocky mountain regions, the pressure being least in Arizona.

Compared with the previous month, the pressure has diminished from 0.1 to 0.15 of an inch in the lake region, and from 0.1 to 0.2 of an inch in New England, the middle states, and Saint Lawrence valley. On the Pacific coast, the pressure has fallen slightly, the distribution of pressure remaining unchanged. The low area in the Rocky mountain region occupies about the same position as that of May, but the isobar of 29.80 includes within its limits, Arizona, New Mexico, Colorado, and Utah, and parts of Nevada, Nebraska, Wyoming, and Idaho.

DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Compared with the means of June of previous years, the pressure differs slightly from the normal in the Southern states and at the Rocky mountain stations, and it is from 0.05 to 0.1 below the normal in New England and the middle states. It is also slightly below the normal on the North Pacific coast.

BAROMETRIC RANGES.

The barometric pressure during the month of June has varied from 0.18 of an inch to 0.9 of an inch, the least range being at Campo, California, and the greatest range being at Escanaba, Michigan; generally the range increases with the latitude, and, on the same latitude, the range on the Pacific coast is equal to about one-half the range on the Atlantic coast.

In the several districts the barometric ranges have been as follows:

New England: 0.8 inch at Portland, 0.81 inch at Springfield, and 0.68 inch on the summit of Mount Washington.

Middle Atlantic states: 0.86 inch at Albany, 0.62 inch at Norfolk.

South Atlantic states: 0.58 inch at Kittyhawk, and 0.40 inch at Jacksonville.

Florida peninsula: 0.25 inch at Key West, and 0.34 inch at Cedar Keys.

East Gulf states: 0.52 inch at Starkville, and 0.49 inch at Montgomery.

West Gulf states: 0.67 inch at Little Rock, and 0.33 inch at Brownsville.

Ohio valley and Tennessee: 0.61 inch at Memphis, 0.54 inch at Cincinnati, and 0.51 inch at Knoxville.

Lower lake region: 0.77 inch at Oswego, and 0.63 inch at Cleveland.

Upper lake region: 0.90 inch at Escanaba, and 0.72 inch at Chicago.

Upper Mississippi valley: 0.89 inch at Saint Paul, and 0.68 inch at Davenport.

Missouri valley: 0.84 inch at Yankton, and 0.68 inch at Springfield.

Extreme northwest: 0.75 inch at Moorhead, and 0.58 inch at Saint Vincent.

Northern slope: 0.69 inch at North Platte, and 0.51 inch at Cheyenne.

Middle slope: 0.62 inch at Dodge City, and 0.45 inch at Pike's Peak.

Southern slope: 0.67 inch at Henrietta, and 0.38 inch at Stockton.

Northern plateau: 0.53 inch at Umatilla and 0.34 inch at Dayton.

Middle plateau: 0.41 inch at Salt Lake City, and 0.37 inch at Winnemucca.

Southern plateau: 0.39 inch at Santa Fé, and 0.27 inch at Silver City.

North Pacific coast region: 0.52 inch at Portland, and 0.42 inch at Olympia.

Middle Pacific coast region: 0.43 inch at Red Bluff, and 0.30 inch at San Francisco.

South Pacific coast region: 0.32 inch at Yuma, and 0.18 inch at Campo.

AREAS OF HIGH BAROMETER.

Four areas of high barometer have been traced over the eastern part of the United States during the month of June. They were first observed in the region north of the upper Missouri valley, or north of Lake Superior, and moved to the southeast over the Atlantic, developing but slight energy, and causing no unusual change in barometric pressure. In no case has an area of high pressure been traced to the west of the Rocky mountains, while two such areas have apparently approached the north Pacific coast from the Pacific.

I.—The pressure was above the normal for the month in the region north of the Missouri valley on the 1st and 2d, but the development of low area ii, on the eastern slope of the Rocky mountains, apparently retarded the movement of this area. The pressure increased in the western districts on the 4th, a slight excess of pressure appearing over Texas, while the greater pressure continued in British America, north of Dakota. A light "norther" occurred on the Texas coast on the 3d and 4th, in advance of this area, and on the 5th the pressure had increased to 30.20 and above, in the Mississippi and lower Missouri valleys, the centre of greatest pressure being near Springfield, Missouri on the morning of the 5th. The midnight report of the 5th showed that this area was extending eastward over the Southern states, the pressure having increased during the day at stations south of the lake region, and the winds in the southwest shifting to easterly, with light rains in Texas, Indian territory, and Kansas. At the midnight report of the 6th, this area had moved to the east of the coast line, advancing slowly to the southeast, but the pressure continued high in the south Atlantic and Gulf states, with rain gradually extending eastward over the districts as the pressure diminished.

II.—This area appeared in British America, north of Lake Superior and Minnesota on the 10th. It extended over the lake region, Saint Lawrence valley and the middle states, and on the morning of the 12th was central near Montreal, where the pressure was 30.25. At the afternoon report of the 10th this area was central off the middle Atlantic coast, where the pressure continued high until the 14th, when it diminished in advance of low area iv. The pressure increased on the south Atlantic coast as this area passed over New England to the southeast, and, when the barometer fell in the northern districts on the 14th, the region of high pressure was transferred to the Gulf States, where the barometer continued relatively high until the 18th.

III.—This advanced from the northwestward over Lake Superior on the 19th, the isobar of 30.10 enclosing the upper lake region at the midnight report of that date. On the 20th, this area was central over lake Erie, and, on the morning of the 21st, over the middle Atlantic states, enclosed by an isobar of 30.20, which extended from Cape Hatteras to Toronto, Canada. The pressure increased at stations on the Atlantic coast on the 21st, with cool fair weather in New England and the middle states, and without any marked change in the position of this area, which continued over the middle states until the 22d, when it passed slowly to the southeast over the Atlantic, the barometer remaining high in the south Atlantic and Gulf states until the 28th.

IV.—Appeared north of the lake region on the 29th, and extended over the middle states and Saint Lawrence valley, attended by cool northerly winds in these districts on the 29th and 30th. This area disappeared rapidly in advance of low area ix. which was moving eastward from the upper Missouri valley on the morning of the 30th.

Areas of high barometer appeared on the Pacific coast on the following dates, but in no case could they be traced to the east of the Rocky mountains. On the 11th and 12th, the pressure increased to 30.12 at Roseburg and 30.14 at Portland, and continued high until the 18th, reaching the maximum, 30.22, on the 17th. During this period of high pressure on the north Pacific coast, the barometer was below the mean for the month at the central and southern California stations, and over the

middle and southern plateau regions. On the 20th, a second area of high pressure advanced from the Pacific over Oregon and Washington territory, accompanied by cool north to west winds and fair weather, which continued until the close of the month, the pressure in California remaining generally below the mean.

AREAS OF LOW BAROMETER.

Nine areas of low pressure appeared within the limits of the Signal Service stations, sufficiently well-defined to render it possible to trace the movements of each, during at least three consecutive tri-daily reports.

On chart i. will be found the tracks of the centre of these depressions, seven of which reached the Atlantic coast, passing to the east of the Saint Lawrence valley, north of the mean track of the low areas of June. Two extended areas of low pressure developed in the Rocky mountain regions, where they remained almost stationary for several days. The centres of these depressions have been approximately located, with a view of illustrating the continuance of low areas in the Rocky mountain regions, during summer months.

The following table gives the latitude and longitude in which each area was first and last observed, and the average hourly velocity:

Areas of low barometer.	First Observed.		Last Observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.	45° 30′	103° 00′	47° 30′	60° 00′	23.8
II.	42° 00′	102° 30′	42° 00′	60° 00′	24.0
III.	42° 00′	112° 00′	37° 00′	107° 00′	
IV.	37° 30′	103° 00′	50° 30′	69° 00′	30.5
V.	47° 30′	93° 00′	47° 00′	77° 30′	28.1
VI.	47° 00′	104° 00′	47° 30′	77° 00′	26.0
VII.	46° 30′	109° 00′	40° 00′	102° 00′	
VIII.	48° 00′	86° 00′	48° 00′	59° 00′	31.0
IX.	40° 00′	115° 00′	44° 00′	82° 00′	24.4

The noticeable feature of chart i. is the absence of storm tracks from the southern states and Atlantic coast districts. No depression appeared south of the fortieth parallel of latitude, except on the middle Rocky mountain slope.

The following table gives the number of areas of low pressures during the month of June, since 1873.

Month.	Year.	No.	Month.	Year.	No.
June.	1873,	10.	June.	1878,	10.
"	1874,	9.	"	1879,	9.
"	1875,	7.	"	1880,	13.
"	1876,	6.	"	1881,	6.
"	1877,	11.	"	1882,	9.

I.—This depression developed in Dakota on the 29th of the preceding month, and passed slowly to the eastward over Minnesota and Michigan with increasing energy, causing dangerous winds on lakes Erie and Huron, cautionary signals having been displayed in advance. On the morning of the 1st this depression was central in the Saint Lawrence valley, northwest of Montreal, where the barometer had fallen to 29.36. Heavy rains occurred in the districts on the Atlantic coasts on the 1st, and dangerous southwest to northwest winds prevailed on the Atlantic coast from Eastport to Jacksonville. This storm apparently lost much of its energy after reaching the Atlantic, and when last observed, north of Nova Scotia, the pressure at the centre had increased and the isobars were less crowded than they had been when the centre of this disturbance was passing over the lake regions. The following maximum wind velocities were reported during this storm: Hatteras, 52, sw.; Delaware Breakwater, 40, sw.; Cape May, 40, s.; Sandusky, 46, sw.; Smithville, 30, sw.; Cedar Keys, 31, s. A heavy southeast gale, accompanied by heavy rains, occurred near Cape Cod on the 1st, the wind reaching its maximum velocity about 11 a. m., when the tide was unusually high. Captain Gregson, of the s. s. "Circassian," reports, May 30th, at 8.30 a. m., in latitude N. 47° 35′, longitude W. 57° 05′, barometer 29.53. The wind, which was easterly, force 4, with passing rain and fog, suddenly shifted to nw., se. and back to se., and then to sw., making this revolution several times, and the weather also suddenly cleared up. About a mile from the ship the water appeared to curl up as if from the force of the wind, but at the ship the wind was nearly calm, or of force 1. The wind eventually settled down and blew from the ene., force 7 to 8, and decreased in force toward noon.

The following reports, furnished through the co-operation of "The New York Herald Weather Service," probably indicate the presence of this storm during its movement eastward over the ocean: s. s. "Lepanto," 2d, in N. 42° 32′, W. 56° 57′, barometer 29.83, wsw., force 6, drizzling rain; s. s. "P. Calland," 5th, in N. 41° 27′, W. 48° 30′, barometer 29.87, ssw., force 5, cloudy; s. s. "Adriatic," 4th, in N. 45° 05′, W. 39° 45′, strong head wind and sea; 6th, in N. 41° 52′, W. 52° 54′, strong ssw. wind and head sea.

II.—This depression was central in western Nebraska on the afternoon of the 1st, enclosed by an isobarometric line of 29.70 extending over the eastern slope of the Rocky mountains, north of the Arkansas valley, with rain at all stations in the upper Missouri valley. On the morning of the 2d the centre of disturbance had moved eastward to Omaha, and the depression extended southward to northern Texas, while the rain-area had moved eastward to Michigan and the lower Ohio valley. This storm continued its easterly course during the 2d and until the morning report of the 3d, passing over Iowa and Illinois with increasing energy, and accompanied by very heavy rains near the centre of disturbance. A secondary depression formed over northern Texas on the 2d, but disappeared as the original depression passed to the eastward. On the morning of the 3d, the course changed to the northeast, the centre was near Chicago, and the disturbance passed over southern Michigan and the lower lake region, causing severe gales, barometer at the centre falling below 29.50, and the storm becoming more clearly defined as a cyclonic disturbance. Heavy rain occurred in the lake region on the 3d, accompanied by dangerous winds on lakes Michigan, Huron and Erie. This storm passed to the north of the lower lake region, with decreasing force and increasing pressure at the centre. At the midnight report of the 4th the barometer was low at all stations in the northeastern part of the United States and in the Saint Lawrence valley, and the isobarometric lines indicated that this depression had moved eastward over northern New England. On the morning of the 5th, the centre was near Eastport, the lowest isobar, 29.60, enclosing the centre of disturbance and extending from Montreal to Halifax. The pressure continued low in the northeast during the 5th, and the winds in New England, and at stations northeastward, shifted to westerly, indicating the continued northeasterly movement of the depression. The following maximum velocities of wind occurred during this storm: Hatteras, 40 sw.; Delaware Breakwater, 43 s.; Milwaukee, 42 n.; Grand Haven, 40 w.; Sandusky, 37 w.; Toledo, 36 w.; Detroit, 32 sw. Destructive local storms were reported in Virginia and North Carolina on the 4th, which were in some cases accompanied by hail. The following vessel reports, furnished through the co-operation of the "New York Herald Weather Service," probably indicate the presence of this storm during its eastward movement over the ocean: 5th, s. s. "Gallia," N. 40° 37′, W. 70° 54′, barometer 29.79, sw., force 5, lightning; 6th, s. s. "City of Montreal," in N. 41° 37′, W. 63° 57′, strong head winds

III.—The area of high barometer, which followed low area ii., extended slowly over the districts east of the Mississippi, where the pressure continued relatively high until the 21th, while, at the Rocky mountain stations, the barometer continued below the mean. The low area traced as iii. was a large barometric depression, generally enclosed by an isobar of 29.70, and including within its limits, Colorado, New Mexico and Utah. The position of the centre of this depression has been located approximately at each report from the date of its appearance on the 12th. The barometer continued low in this region,

from the 12th to the 13th, but the general distribution of pressure and direction of wind at the Rocky mountain stations, did not warrant the continuation of the track of this depression as a part of that traced as iv. A severe tornado occurred in St. Clair county, Michigan, on the 8th, when the pressure was lowest near Salt Lake City, but an examination of the weather chart of that date indicated the presence of a slight depression in the upper Mississippi valley, with northerly winds over Lake Superior and southerly winds in eastern Iowa and southern Illinois. Very heavy winds occurred in Iowa on the 10th, when the barometer was lowest in Colorado.

IV.—This depression was central in eastern Colorado on the morning of the 13th; the barometer at Denver reading 29.62, and that of Cheyenne, 29.63, with northerly winds and light rain. This depression extended in a north and south direction, from Texas to northern Dakota, the winds being from east to south in the Mississippi and Missouri valleys, accompanied by light rains. This area moved northward into western Nebraska during the day, enclosed by an elliptical isobar, the longer axis of which inclined slightly to the east, and extended from Santa Fé to Bismarck. The course changed to the eastward during the night of the 13th, and the centre passed over southern Minnesota, central Wisconsin, and the southern part of Lake Superior on the 14th, the storm increasing in force and becoming more contracted as it approached the lake region. The rain-area of this depression extended over the states north of the Ohio valley, but the amount of precipitation was slight. After passing to the east of the lake region over the Saint Lawrence valley, the pressure diminished at the centre, and the disturbance became more extended; rain fell in New England and the middle Atlantic states as the centre of this disturbance passed to the eastward and northward of these districts. At the 7 a. m. report of the 16th, when the centre of disturbance was near Farther Point, the barometer at that station read 29.41; the following maximum velocities of wind were reported at stations on the lakes: Milwaukee, 36; Grand Haven, 38; Port Huron, 36; Sandusky, 25.

V.—This depression developed rapidly during the 16th, and was probably central near the western part of Lake Superior on the morning of that date. At the p. m. report of the 16th, it was central in Wisconsin as a slight disturbance, causing light rains in the upper lake region and thence southward to the Ohio valley. This depression moved southeasterly until the centre reached Lake Huron on the morning of the 17th, when the a. m. weather chart exhibited a trough of low pressure, extending from the upper Saint Lawrence to the upper Missouri valley. This area became less defined during the 17th, and finally disappeared to the northeast of Lake Huron, the course changing after the morning report of that date. Light rains occurred in all districts east of the Mississippi on the 17th, when this depression was moving to the northeast of the lakes.

VI.—This depression was first observed as central in Dakota, at the midnight report of the 16th. It became more clearly defined during the 17th, as the centre moved in a southeasterly direction, enclosed by an isobar of 29.50, at the p. m., report of the 17th. At midnight of the 17th, the centre of this storm had reached northern Iowa, the barometer at Des Moines reading 29.34, wind w.; Omaha, 29.44, wind nw,; Saint Paul, 29.42, wind e.; Huron, Dakota, 29.46, wind nw.; at this report, the depression was elliptical in form, the longer axis being in a north and south direction, inclining slightly to the westward. On the 18th the centre passed to the northeast near Saint Paul, where the barometer fell to 29.24 at the 7 a. m., report, and at the same report, the observer at Duluth reported barometer 29.41, violent ne., gale and heavy rain. This storm passed directly eastward over Lake Michigan, causing severe gales, and heavy rains; after passing to the eastward of the lake region, the pressure increased at the centre, and the storm lost much of its energy before passing beyond the limits of observation. The succeeding reports indicate that it disappeared as a slight disturbance, northeast of Nova Scotia on the 20th. Under the heading of local storms, will be found a description of the tornadoes which occurred while this depression was passing over the northern part of the United States.

VII.—This depression was first observed in the upper Missouri valley on the morning of the 19th. The pressure continued below the normal in this region during the 19th and 20th, when the centre of low pressure moved southward to Colorado, leaving a slight secondary depression in Dakota, on the afternoon of the 20th. This depression continued in Colorado until the midnight report of the 21st, when it disappeared before reaching the Missouri valley.

VIII.—Was central north of Lake Superior on the 24th, and passed eastward over the lower Saint Lawrence valley, causing only a slight disturbance in northern districts of the United States. It was at no time within the limits of the Signal Service stations, and the position of the centre is only approximately located at the tri-daily telegraphic reports.

The following report furnished by Captain Moody, of the s. s. "State of Georgia," probably indicates the presence of this storm: 26th, in N. 41° 01′, W. 56° 27′, barometer 29·76, wind sw., force 7, heavy rain.

IX.—An extended area of low pressure was central in the southern plateau region, on the morning of the 27th; this depression moved slowly to the eastward over Utah and Colorado, during the 27th and 28th, when its course changed to the north. On the morning of the 29th, it was central near Deadwood, Dakota, where the barometer was slightly below 29.70; on this, and the following day, this disturbance moved directly eastward over the lake region, with increasing energy and at the close of the month, it was central near Saugeen, where the barometer read 29.57. Cautionary signals were ordered at stations on Lakes Michigan, Huron, and Erie, in advance of this storm; these signals were justified by dangerous winds on Lakes Erie, and Huron, but they were not justified at stations on the southern and western shores of Lake Michigan.

INTERNATIONAL METEOROLOGY.

International charts iv. and v. accompany the present number of this REVIEW. Chart iv. is published for April, 1880, and continues the series of that chart begun in January, 1877. Chart v. is prepared for July, 1880, and continues the series of that chart from November, 1877. In the description of these charts, much valuable information has been obtained from the "Monatliche Uebersicht der Witterung," published by Prof. Dr. G. Neumayer, Director of the German Marine Observatory, and from the "Bulletin Mensuel," published by Mr. Marc Dechevrens, of Zi-Ka-Wei, China.

Chart iv. exhibits the mean pressure, mean temperature and prevailing direction of the wind over the northern hemisphere for the month of April, 1880, as determined from one observation taken each day at 7.35 a. m. or 0.43 p. m., Greenwich mean time.

The area of lowest mean pressure occupies southeastern Greenland, the mean pressure at Godthaab being 29.54 (750.3 m. m.), prevailing wind, south, force 4. The barometric gradients increase slowly toward the east and southeast, but in the south the increase is more rapid.

A second area of mean low barometer extends over British India, where the lowest mean pressure for the month was 29.63 (752.6 m. m.).

An area of relatively mean low pressure, 29.90 (759.4 m. m.), extends over the United States from the lake region southward and westward to the Rocky mountains.

The isobar of 29.90 (759.4 m. m.) also covers the European continent from northern Russia southward to the Black sea and the Mediterranean, and westward to the North sea and Bay of Biscay.

Three areas of barometric maxima appear on the chart.

The first area of mean high barometer, 30.20 (767.7), is that of the Atlantic, which extends over the ocean between the